

REMARKS

The Final Office Action mailed June 5, 2006, has been received and reviewed. Claims 31 through 38, and 40 through 48 are currently pending in the application. Claims 31 through 38, and 40 through 48 stand rejected. Applicants propose to amend claim 31. Reconsideration is respectfully requested.

35 U.S.C. § 103(a) Obviousness Rejections

Obviousness Rejection Based on U.S. Patent No. 5,780,908 to Sekiguchi et al. in view of U.S. Patent No. 6,114,238 to Liao

Claims 31 through 38, and 40 through 48 stand rejected under 35 U.S.C. § 103(a) as being unpatentable over Sekiguchi et al. (U.S. Patent No. 5,780,908) in view of Liao (U.S. Patent No. 6,114,238). Applicants respectfully traverse this rejection, as hereinafter set forth.

M.P.E.P. 706.02(j) sets forth the standard for a Section 103(a) rejection:

To establish a *prima facie* case of obviousness, three basic criteria must be met. First, there must be some suggestion or motivation, either in the references themselves or in the knowledge generally available to one of ordinary skill in the art, to modify the reference or combine reference teachings. Second, there must be a reasonable expectation of success. Finally, **the prior art reference (or references when combined) must teach or suggest all the claim limitations.** The teaching or suggestion to make the claimed combination and the reasonable expectation of success must both be found in the prior art, and not based on applicant's disclosure. *In re Vaeck*, 947 F.2d 488, 20 USPQ2d 1438 (Fed. Cir. 1991). (Emphasis added).

Sekiguchi discloses a semiconductor apparatus with a tungsten nitride barrier layer. After the formation of the tungsten nitride barrier layer, an aluminum alloy layer is deposited thereover. (Abstract). The formation of the barrier layer prevents the formation of a tungsten-aluminum alloy which has a high resistance which is undesirable for an interconnection. (Sekiguchi, col. 3, lines 26-30). Liao discloses a self-aligned metal nitride for copper passivation. A metal plug 104 is deposited in a hole in a dielectric layer 102. Prior art methods included depositing a second dielectric layer 108 over the metal plug 104. However, this lead to reliability problems. (Liao, col. 1, line 34-39). Therefore, Liao discloses a second metal layer 212a over the metal plug 208 before further processing. The second metal layer 212a functions as a barrier layer. (Liao, col. 1,

lines 41-45). Applicants respectfully submit that the proposed combination of references fails to teach or suggest every element of the presently claimed invention.

Applicants respectfully submit that claim 31 is not rendered obvious by the combination of Sekiguchi in view of Liao. Claim 31 of the presently claimed invention recites a “method of reducing oxidation of an electrically conductive material, comprising: forming a first dielectric layer on a semiconductor structure, the first dielectric layer comprising a depression therein; filling the depression with an unoxidized electrically conductive material; reacting a chemical composition with an upper surface of the electrically conductive material to form a chemical compound more resistant to oxidation than the electrically conductive material; and forming a second dielectric layer over the electrically conductive material and the first dielectric layer and adhering the second dielectric layer to the electrically conductive material wherein reacting a chemical composition and forming a second dielectric layer occur simultaneously.” Support for the amendment may be found throughout the as-filed specification, for example, page 9, lines 13-15.

Applicants respectfully submit that the proposed combination of references fail to teach or suggest “reacting a chemical composition with an upper surface of the electrically conductive material to form a chemical compound more resistant to oxidation than the electrically conductive material; and forming a second dielectric layer over the electrically conductive material and the first dielectric layer and adhering the second dielectric layer to the electrically conductive material wherein reacting a chemical composition and forming a second dielectric layer occur simultaneously.”

Additionally, no motivation exists to combine the references to teach all of the limitations of claim 31 of the presently claimed invention. The Examiner relies upon Liao for teaching “forming a second dielectric layer over the electrically conductive material and the first dielectric layer and adhering the second dielectric layer to the electrically conductive material.” Applicants respectfully disagree that Liao teaches forming an inter-metal dielectric over conductive material. (See Office Action, page 3). Instead, Liao teaches that prior art methods included depositing a second dielectric layer 108 over a metal plug 104. However, this lead to reliability problems. (Liao, col. 1, line 34-39). Therefore, Liao discloses a second metal layer 212a over the metal

plug 208 before further processing. The second metal layer 212a functions as a barrier layer. (Liao, col. 1, lines 41-45).

No motivation exists to form the prior art inter-metal dielectric layer over the electrically conductive material and first dielectric layer and adhering the inter-metal dielectric layer to the electrically conductive material in Sekiguchi. Instead, Sekiguchi teaches an aluminum alloy layer 8a over the tungsten layer 7 to decrease the interconnection resistance. (Sekiguchi, col. 12, lines 39-45). As Liao teaches that depositing a second dielectric layer over a metal plug leads to reliability problems, no motivation exists to substitute a dielectric layer for the aluminum alloy layer of Sekiguchi. (Liao, col. 1, line 34-39).

Similarly, no motivation exists eliminate the barrier layer 212a of Liao, to react “a chemical composition with an upper surface of the electrically conductive material to form a chemical compound more resistant to oxidation than the electrically conductive material” and to form “a second dielectric layer over the electrically conductive material and the first dielectric layer and adhering the second dielectric layer to the electrically conductive material.” Instead, Liao teaches the barrier layer 212a is important to prevent diffusion of copper from metal plug 208. There is no teaching or suggestion in Sekiguchi that exposing the Liao copper plug to nitrogen gas will create an effective barrier. Similarly, no motivation exists in either reference to modify Sekiguchi to form a second dielectric layer over the electrically conductive material and the first dielectric layer and adhering the second dielectric layer to the electrically conductive material. Instead, Sekiguchi discloses an aluminum alloy is adhered to the tungsten plug.

As no motivation exists to combine the cited references, Sekiguchi in view of Liao cannot render claim 31 obvious. Accordingly, claim 31 is allowable.

Claims 32 through 34 and 36 through 38 are each allowable as depending, either directly or indirectly, from allowable claim 31.

Independent claims 40 and 45 are both allowable at least for the same reasons stated for independent claim 31. Independent claims 40 and 45 both include similar recitation of “forming a second dielectric layer over the electrically conductive material and the first dielectric layer and adhering the second dielectric layer to the electrically conductive material.” As stated, Sekiguchi

in view of Liao fails to teach or suggest this limitation. Accordingly, claims 40 and 45 of the presently claimed invention are allowable.

Claims 41 through 44 are each allowable as depending, either directly or indirectly, from allowable claim 40.

Claims and 46 through 48 are each allowable as depending, either directly or indirectly, from allowable claim 45.

ENTRY OF AMENDMENTS

The proposed amendments to claim 31 above should be entered by the Examiner because the amendments are supported by the as-filed specification and drawings and do not add any new matter to the application. Further, the amendments do not raise new issues or require a further search. Finally, if the Examiner determines that the amendments do not place the application in condition for allowance, entry is respectfully requested upon filing of a Notice of Appeal herein.

CONCLUSION

Claims 31-38 and 40-48 are believed to be in condition for allowance, and an early notice thereof is respectfully solicited. Should the Examiner determine that additional issues remain which might be resolved by a telephone conference, the Examiner is respectfully invited to contact Applicants' undersigned attorney.

Respectfully submitted,



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